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EVALUATION OF APTITUDE AND ACHIEVEMENT COMPOSITES FOR THE INITIAL CLASSIFICATION OF MARINE CORPS OFFICERS

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As part of an ongoing project to develop a classification system for Marine Corps officers, aptitude, background, and performance data routinely collected by the Marine Corps were analyzed to determine their usefulness as predictors of performance in 12 follow-on specialty schools. Four schools had samples large enough for the development and cross-validation of multiple regression composites. Evaluation of manual and computer-assisted optimal assignment methods based on the composites indicated that the composites are effective in differentially predicting follow-on school performance.

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FOREWORD

This is an interim report on research and development being conducted in support of Exploratory Development Task Area ZF63-521-080-101 (Marine Corps Personnel Resources Management) under the sponsorship of the Commandant, U.S. Marine Corps (MPI-20). The work was initiated in response to a request from the Officer Assignment Branch, Headquarters, Marine Corps, to develop an objective classification system for assigning officer students at The Basic School (TBS), Quantico, Virginia to their first Military Occupational Specialties.

The continuous assistance and coordination activities of Major B. T. Babin of the Manpower Management Research Section, HQMC, are gratefully acknowledged. Appreciation is also expressed to the personnel from the Testing and Evaluation Office at TBS for their cooperation in providing data used in this investigation.

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SUMMARY

Problem

Current procedures for assigning unrestricted Marine Corps officer students at The Basic School (TBS) to the Military Occupational Specialties (MOSs) open to them do not include objective measures of the officers' aptitude for and interest in those MOSs. In addition, assignment decisions are reached through a complicated manual process that is unsystematic, partially subjective, and often inequitable. The Marine Corps has indicated a need for improving this system to satisfy increasing requirements for technical and professional competency in all MOSs and to ensure better utilization of officer talent.

Purpose

The purposes of the overall project are (1) to develop empirically derived measures of an officer's background, aptitude, and interest in various MOSs, (2) to design a classification system based on these measures, and (3) to formulate a method for implementing this system in officer classification.

The purpose of the work reported herein was to evaluate aptitude, background, and performance information routinely collected by the Marine Corps for its potential usefulness in predicting performance in follow-on specialty schools. If valid predictors are identified, an interim system can be developed that could be applied to some or all of the MOSs.

Approach

The original sample consisted of Marine Corps officers who had graduated from TBS between 1972 and mid-1977, who had completed a follow-on school course in any of the 12 MOSs open to them during this period, and for whom final school grades (FSGs) were available. Aptitude test scores, achievement measures, and civilian education major were considered as potential predictors of FSG, the criterion of follow-on school performance.

Multiple regression analyses were performed to determine the validities of various combinations of the predictor variables for predicting an officer's success in the four schools with sample sizes large enough for the development and cross-validation of multiple regression composites--Combat Engineer (CE), Basic Communication (BC), Ground Supply (GS), and Field Artillery (FA). To identify those predictor combinations that most accurately predict differences in success in the four schools--and thus would be the most useful for officer classification--composite scores computed from these combinations were used to make simulated assignments with a computer-based optimal-assignment procedure. Finally, a set of simplified composites, and instructions for their use, were developed to provide assignment personnel with a manual method for computing predicted scores that could be readily incorporated into current assignment procedures.

Results

Validities for all the composites were quite high and were maintained in cross-validation. The optimal assignment results indicated that the composite scores were effective in predicting differences in performance at the four follow-on schools. Increasing accuracy and greater differentiation were obtained as more information went into the development of the composites. Civilian education major did not significantly contribute to the prediction of performance.

Conclusions and Recommendations

1. Composites based on TBS course grades and aptitude test scores are strong predictors of differential performance at these schools.

2. Evaluation of manual and computer-assisted assignment methods based on the composites indicated that use of the composites can enhance and facilitate classification decisions, while requiring minor additions to present procedures. Therefore, it is recommended that use of the composites be incorporated into the current MOS assignment process.

3. For the remaining MOSs, it is recommended that larger samples be collected and follow-on schools curricula analyzed for the purpose of grouping related MOSs that alone do not yield enough subjects.

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INTRODUCTION

Problem and Background

Each year, approximately 1800 unrestricted Marine Corps officers (2nd lieutenants) from all commissioning sources attend The Basic School (TBS), Quantico, VA where they receive a common curriculum of military training before being sent to specialty schools and job assignments. About 400 of these officers have aviation or law specialty guarantees before entering TBS; however, the remainder must be assigned to one of the 22 other Military Occupational Specialties (MOSs) open to them. Until recently, only 12 other MOSs were available to these officers. However, in an effort to fill undermanned, previously restricted specialties, 10 additional MOSs were made available. Assignment decisions are made by company commanders in conjunction with Headquarters, Marine Corps (HQMC) during the 7th or 8th week of the 21-week TBS course, and are based primarily on quotas for each MOS, individual preferences, TBS performance, and educational background. Assignments are made 7 or 8 times a year, and affect from 150 to 200 students.

In the past, students who performed best in TBS were most likely to obtain their MOS preference. Although this system provided considerable incentive for TBS performance, it had at least one undesirable effect. Individuals with the best TBS performance naturally selected the most popular MOSs, which led to a perceived inequity in the distribution of talent across MOSs.

To combat this trend, a "quality spread" procedure was introduced. With this procedure, each TBS class is divided into thirds according to class standing, and individuals in each third are proportionally distributed among the MOSs. Those in the upper portion of each third have the best chance of receiving their preferred MOS. Although this procedure tends to even out the distribution of quality, it introduces an additional burden to an already complex manual assignment system and has inherent weaknesses. For instance, it assumes that overall TBS performance, as determined less than one-third of the way through TBS, is an adequate measure of quality and that it is related to subsequent performance in a specialty. Also, it could cause student dissatisfaction, since a student who ranks at the top of the bottom third has a better chance of getting his preferred MOS than another student who ranks well above the first student but is at the bottom of the top third.

In addition to the disadvantages of the quality spread procedure, there are other problems in the present assignment system. First, regardless of interest and qualifications, informal social pressure on individuals, particularly those who do well in TBS, may cause some to select an MOS for which they are not best suited. Second, because of a lack of Marine Corps experience, students often have limited knowledge of MOS characteristics by the 7th or 8th week in TBS, when they must indicate MOS preferences. Finally, there is no systematic procedure to identify, prior to MOS assignment, those officers who do not meet the specialized requirements of some of the follow-on schools (e.g., good hand-eye coordination, in the Air Support and the Air Defense schools).

In response to these problems, a Marine Corps study group tasked to review the unrestricted officer concept recommended that the Marine Corps "evaluate alternative approaches toward enhancing the officer classification process through the development of a means of giving greater weights to civilian education, measured aptitudes, and

individual characteristics in MOS assignments."[1] Subsequently, the Marine Corps asked NAVPERSRANDCEN to develop an objective classification system for assigning TBS students to their first MOS. This report describes the initial phase of a research program designed to implement that recommendation.

Purpose

The purposes of the overall project are (1) to develop empirically derived measures of an officer's background, aptitude, and interest in different MOSs, (2) to design a classification system based on these measures, and (3) to formulate a method for its implementation in officer classification.

The purpose of this initial phase was to evaluate aptitude, background, and performance information routinely collected by the Marine Corps for its potential usefulness in predicting performance in follow-on specialty schools. If valid predictors are identified, an interim system can be developed that could be applied to some or all of the MOSs.

APPROACH

Subjects

The original sample consisted of Marine Corps officers whose personnel records indicated they had graduated from TBS between 1972 and mid-1977 and who had completed a follow-on school course in any of the original 12 MOSs. (The other ten were not included in this research because of insufficient historical data.) Subsequently, officers in Infantry were excluded because it had only recently acquired a follow-on school; and those in Data Systems, because of inadequate sample size. Table 1 shows the sample size and follow-on school for the 10 remaining MOSs.

Predictors

Civilian Education Major Categories (CEMC)

There are about 260 civilian education majors in the Marine Corps data base. They were grouped under six categories: (1) engineering and architecture, (2) business management, (3) physical sciences, (4) social sciences, (5) arts and humanities, and (6) trades and services (see Appendix A). The CEMCs of sample members are presented in Table 2.

To obtain samples large enough for statistical analysis, the officers in the engineering and architecture and physical sciences categories were combined into a technical category; and those in the social sciences and arts and humanities categories, into a nontechnical category. Final school grade (FSG) means and standard deviations for sample members in the technical, business and management, and nontechnical categories are provided in Table 3.

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[1]Deputy Chief of Staff for Manpower memorandum MMPA:RRR:rgt 5310 of 21 March 1977 to the Directors of the Personnel Management and Manpower Plans and Policy Divisions.

Table 1

Follow-on Schools Included in the Study

MOS	School	N	Duration (weeks)
7208	Air Support (AS)	55	9.5
1302	Combat Engineer (CE)	220	6
7204	Anti-Air Warfare (AAW)	32	6 or 8
2502	Basic Communication (BC)	172	11
3002	Ground Supply (GS)	267	9 or 12
0802	Field Artillery (FA)	423	10
3060	Aviation Supply (AS)	77	14 or 18
1802	Tank (T)	82	12
1803	Amphibious Vehicle (AV)	20	5 or 6
7210	Air Defense (AD)	70	10.5
		1418	

Table 2

Civilian Education Major Categories of Sample Members by School

Follow-on School	Eng. & Archi-tecture	Busi-ness & Manage-ment	Physical Sciences	Social Sciences	Arts & Humani-ties	Trades & Services	No Major	Total
Air Sup-port	3	2	9	17	9	2	13	55
Combat Engineer	30	19	23	72	16	2	58	220
Anti-Air Warfare	3	3	2	9	1	1	13	32
Basic Com-munica-tion	11	10	21	67	17	0	46	172
Ground Supply	10	63	24	83	15	2	70	267
Field Artillery	30	53	38	161	35	2	104	423
Aviation Supply	1	26	5	22	9	0	14	77
Tank	3	9	10	35	5	0	20	82
Amphibious Vehicle	2	2	3	7	1	0	5	20
Air Defense	7	2	9	25	9	2	16	70
Total	100	189	144	498	117	11	359	1418

Table 3

Mean Final School Grade (Standardized Mean = 0, SD = 1)
By Civilian Education Major Category (CEMC)

Follow-on School	Civilian Education Major Category								
	Technical[a]			Business and Management			Nontechnical[b]		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Air Support	-.44	.98	12	-.95	1.03	2	.02	1.05	26
Combat Engineer	.06	.97	53	-.46	1.48	19	.06	1.00	88
Anti-Air Warfare	.54	.62	5	.42	.59	3	.01	1.12	10
Basic Communication	-.23	1.11	32	-.34	1.22	10	.05	1.00	84
Ground Supply	.43	.90	34	-.12	1.09	63	-.07	.96	98
Field Artillery	-.06	1.33	68	.08	.83	53	-.03	.96	196
Aviation Supply	.04	.73	6	.03	.93	26	.16	1.10	31
Tank	.39	.92	13	-.31	.92	9	-.15	1.04	40
Amphibious Vehicle	-.27	.80	5	-.87	1.56	2	.24	1.12	8
Air Defense	.27	.88	16	.94	.19	2	-.10	.93	34
Total			244			189			615

Note. This table does not include the 11 officers with "trades and services" majors and the 359 officers with no major who were included in the standardization but not in the analyses (see Table 2).

[a]Includes officers in the engineering and architecture and physical sciences categories.

[b]Includes officers in the social sciences and arts and humanities categories.

To determine if CEMCs are related to follow-on school performance, a two-way analysis of variance (the four large sample schools--CE, BC, GS, and FA by the three CEMCs) was performed with standardized FSG as the dependent variable.[2] Results are provided in Table 4, which shows that there was a mild interaction ($p = .046$) between the two factors. Thus, a strength of association index (ω^2) was computed (Hays, 1973). The very small value of this index (.009) indicates that the relationship between the two factors has no practical significance. Therefore, CEMC was eliminated from the predictor set.

Table 4

Analysis of Variance of Follow-on School by Civilian Education Major Category (CEMC)

Source of Variation	SS	df	Mean Square	F	p	ω^2
Main effects	5.947	5	1.189	1.123	.346	
School	4.181	3	1.394	1.316	.268	
CEMC	4.118	2	2.059	1.945	.144	
2-way Interaction:						
School X CEMC	13.671	6	2.279	2.152	.046	.009
Explained	15.927	11	1.448	1.368	.183	
Residual	832.186	786	1.059			
Total	848.113	797	1.064			

Note. ω^2 = strength of association index. The formula used to compute ω^2 is given in Hays (1973, p. 513). Formula 12.34.7 was used.

Aptitude Tests

General Classification Test (GCT). The GCT is an aptitude battery comprised of four subtests: Reading and Vocabulary (GCT-RV), Arithmetic Reasoning (GCT-AR), Arithmetic Computation (GCT-AC), and Pattern Analysis (GCT-PA).[3]

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[2] CEMC was considered separately because it is not free from bias. That is, an individual's college major may influence assignment to some MOSs to some degree, and its weight in assignment decisions may depend on the student's grade point average, which was not available for this study.

[3] A more comprehensive differential aptitude battery, the Air Force Officer Qualification Test (AFOQT), has been experimentally administered to TBS students since June 1978 and will be included as a predictor in later phases of this research. Another aptitude test, the Officer Aptitude Rating (OAR), was initially considered as a predictor but had to be excluded because scores were not available for most sample members.

Army Language Aptitude Test (ALAT). The ALAT is a 59-item test designed to measure linguistic aptitude.

TBS Course Grades

Since TBS course designators, content, schedule, and organization are often changed, grades for only those courses meeting the following criteria were considered as predictors: (1) the course content had to be essentially the same across all TBS classes included in the study, (2) the course had to be part of the curriculum as of December 1978, (3) the course either had to be scheduled early in the curriculum structure (i.e., prior to MOS assignment), or it could potentially be rescheduled if study results showed that it significantly improved prediction, and (4) it had to have a sample size large enough for stable analyses. The following six courses met these criteria: Basic Tactics, First Command Evaluation, Personnel Administration, Military Law, Crew-served Weapons, and Communication. The first two courses listed are "early" courses and the latter four, "anytime" courses. (A listing of all the courses/tests originally available, plus sample sizes, is provided in Appendix B.)

The final list of predictors included the GCT total score, the four GCT subtest scores, the ALAT score, and the grades obtained on the six TBS courses listed above. These predictors were used to form the four predictor sets shown in Table 5.

Table 5

Experimental Predictor Sets

Predictors	Set I	Set II	Set III	Set IV
Aptitude Test Score:				
GCT Total	X		X	
GCT RV Subtest		X		X
GCT AC Subtest		X		X
GCT AR Subtest		X		X
GCT PA Subtest		X		X
ALAT	X	X	X	X
TBS Course Grade:[a]				
Basic Tactics	X	X	X	X
1st Command Evaluation	X	X	X	X
Personnel Administration			X	X
Military Law			X	X
Crew-served Weapons			X	X
Communication			X	X

[a]The first two courses listed are "early" courses, and the latter four, "anytime" courses.

Criterion

Follow-on school performance, as measured by FSG, was the single criterion.

Analyses

1. Multiple regression analyses were performed (1) to determine whether prediction of follow-on school performance could be improved by forming composites based on aptitude test scores and/or TBS grades, and (2) to assess differential prediction. For the four schools (MOSs) that had samples large enough (N > 100) to permit development and evaluation of such composites--CE, BC, GS, and FA--the total sample was divided into two subgroups using the last digit of each subject's social security number (SSN).[4] Those with digits 0, 1, 3, 5, 7, or 9 (about 60%) were assigned to a developmental sample; and those with digits 2, 4, 6, or 8, to a cross-validation sample.

2. To provide a common performance scale for all follow-on schools, the criterion variable, FSG, was converted to standard Z scores (mean = 0, standard deviation = 1) within each school's developmental sample. Using these samples, the four predictor sets shown in Table 5 were entered into a step-wise multiple regression program to obtain the optimal weights for the prediction of the criterion.

3. Differential prediction with the resulting composites was evaluated in the cross-validation samples by making simulated computer-based assignments based on each set and then comparing predicted school performance under each of the four assignment solutions.

4. Finally, to simplify computations in the event that the selected composites were to be used manually, the exact weights were replaced by integer weights. The resulting composites were then evaluated and appropriate percentile conversion tables prepared.

RESULTS AND DISCUSSION

Mean FSG, standard deviations, and sample size by school and by sex are presented in Table 6. Since there are so few women in the sample (1.6%), no analyses by sex were performed.

Table 7, which presents correlation coefficients between the predictors and the criterion, shows that the majority of the coefficients are statistically significant at the .01 level.

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[4]Consideration was given to grouping some of the smaller schools with similar subject matter (i.e., air support and air defense, tank and amphibious vehicle, ground supply and aviation supply). However, this possibility was dismissed because either the combined sample sizes were still too small or the courses differed in complexity or length.

Table 6

Mean FSGs and Standard Deviations
by School and by Sex

School	Total			Women			Men		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Air Support	55	88.1	4.2	3	87.7	1.3	52	88.2	4.4
Combat Engineer	220	91.0	4.7	2	92.9	1.8	218	91.0	4.8
Anti-Air Warfare	32	91.1	5.5	-	--	--	32	91.1	5.5
Basic Communication	172	88.3	5.7	2	89.9	1.8	170	88.3	5.7
Ground Supply	267	88.1	5.5	6	89.7	4.4	261	88.0	5.6
Field Artillery	423	89.8	5.1	-	--	--	423	89.8	5.1
Aviation Supply	77	86.7	4.6	3	91.0	5.3	74	86.5	4.5
Tank	82	93.4	3.4	-	--	--	82	93.4	3.4
Amphibious Vehicle	20	90.5	3.7	-	--	--	20	90.6	3.7
Air Defense	70	82.6	4.7	6	82.9	5.3	64	82.6	4.6
Total	1418	89.1	5.5	22	88.1	5.2	1396	89.2	5.5

Table 7

Pearson Correlations Between Predictors and FSG

Predictor		Follow-on Schools: Air Support	Combat Engineer	Anti-air Warfare	Basic Communic.	Ground Supply	Field Artillery	Aviation Supply	Tank	Amphibious Vehicle	Air Defense	Total
Aptitude Test Score:[a]												
GCT Total	N	50	206	28	158	258	386	71	79	19	64	1319
	Mean	123.6	126.6	131.2	124.0	122.8	131.3	130.4	126.1	122.1	130.1	127.2
	SD	10.9	13.5	13.8	12.2	11.9	11.7	11.4	12.2	15.5	10.2	12.6
	r	.41**	.53**	.42*	.52**	.51**	.36**	.25*	.57**	.46*	.48**	.41**
GCT RV Subtest	Mean	129.4	130.2	135.5	130.6	128.1	134.5	133.0	131.9	123.4	135.1	131.6
	SD	12.8	13.3	12.5	13.0	12.8	12.2	10.7	11.2	17.6	10.8	12.8
	r	.20	.34**	.27	.24**	.41**	.24**	.25*	.37**	.59**	.27*	.27**
GCT AC Subtest	Mean	117.4	121.5	125.5	118.8	119.3	126.1	127.0	120.0	114.3	126.6	122.4
	SD	12.6	14.9	14.3	14.0	12.4	12.2	12.3	14.2	19.2	12.8	13.6
	r	.27*	.48**	.49**	.44**	.42**	.29**	.05	.51**	.35	.44**	.32**
GCT AR Subtest	Mean	117.5	119.6	124.4	117.9	117.5	125.6	125.3	118.5	115.2	124.4	121.2
	SD	11.4	15.2	15.8	14.8	14.1	12.8	12.9	14.7	17.3	10.9	14.3
	r	.39**	.49**	.40*	.51**	.48**	.32**	.26*	.58**	.33	.45**	.37**
GCT PA Subtest	Mean	119.7	123.5	125.8	119.0	116.9	125.7	123.3	122.7	123.2	122.6	122.1
	SD	16.3	16.1	17.3	17.2	17.4	15.8	15.7	15.6	18.5	15.4	16.7
	r	.38**	.44**	.26	.43**	.33**	.29**	.17	.29**	.22	.25*	.33**
ALAT	N	41	187	28	144	238	371	67	71	20	61	1228
	Mean	20.0	20.5	23.2	23.1	18.7	25.0	24.4	22.0	18.2	21.9	22.2
	SD	9.7	8.8	10.1	10.7	8.8	10.5	9.2	10.8	8.2	9.7	10.1
	r	.43**	.42**	.46**	.38**	.53**	.30**	.35**	.47**	.14	.29*	.35**
TBS Course Grade:[b]												
Basic Tactics	N	31	123	14	101	205	210	54	56	17	36	847
	Mean	90.4	88.2	91.4	91.5	88.3	90.4	90.8	89.6	87.3	89.4	89.6
	SD	9.2	8.6	7.5	7.4	8.1	7.4	7.4	7.1	6.7	8.2	7.9
	r	.56**	.37**	.09	.58**	.54**	.41**	.41**	.54**	.50*	.59**	.42**
1st Command Evaluation	N	39	173	22	121	229	361	67	73	20	53	1158
	Mean	84.0	84.2	81.6	83.0	83.3	85.0	85.1	86.1	82.3	82.1	84.1
	SD	6.4	6.2	8.7	5.5	5.0	6.3	5.8	6.0	4.0	5.7	6.0
	r	.35*	.26**	.26	.22**	.31**	.37**	.36**	.35**	.43*	.36**	.33**
Personnel Administration	N	38	173	22	121	229	361	67	73	20	53	1157
	Mean	87.4	86.7	88.9	88.3	87.0	89.1	90.7	88.0	86.0	90.5	88.2
	SD	6.1	8.1	8.2	9.1	8.5	8.4	7.5	8.4	10.6	7.6	8.4
	r	.56**	.49**	.48*	.66**	.49**	.44**	.45**	.60**	.63**	.57**	.43**
Military Law	N	39	173	22	121	229	361	67	73	20	53	1158
	Mean	86.8	85.8	87.5	88.3	86.4	88.5	89.3	86.6	85.6	86.6	87.3
	SD	8.2	10.1	6.8	8.4	8.7	8.8	7.0	8.6	10.1	11.2	9.0
	r	.53**	.42**	.50**	.48**	.49**	.45**	.49**	.67**	.35	.41**	.41**
Crew-served Weapons	N	31	126	14	103	217	232	58	59	17	39	896
	Mean	88.7	88.4	88.8	86.9	88.1	89.4	90.1	88.8	89.7	89.0	88.6
	SD	7.8	7.5	7.9	8.7	7.8	7.6	6.4	7.3	5.1	7.0	7.7
	r	.45**	.49**	.68**	.67**	.39**	.46**	.37**	.58**	.63**	.49**	.44**
Communication	N	31	127	14	103	217	232	58	59	17	39	897
	Mean	92.6	91.4	91.9	91.6	90.1	92.5	92.3	89.9	92.4	91.2	91.4
	SD	6.6	5.9	5.2	6.2	7.1	6.7	7.6	7.5	3.8	8.7	6.9
	r	.21	.17*	-.27	.25**	.30**	.27**	.35**	.54**	-.16	.49**	.26**

[a]The N for the GCT subtests is the same as that for the GCT total.

[b]The first two courses listed are "early" courses; and the last four, "anytime" courses.

*p < .05
**p < .01.

Development of Multiple Regression Composites

As indicated previously, the total samples for the four large schools were divided into developmental and evaluation samples. The sample sizes, predictor and criterion means, standard deviations, and correlations of all predictors with the criterion in these samples are shown in Table 8.

For each school's developmental sample, four multiple-regression composites were computed, one for each predictor set. Cross-validities for each composite were then computed in the corresponding evaluation samples. Results, which are presented in Table 9, show that validities for all the composites are quite high and are maintained on cross-validation. The validities for composite sets III and IV, which include grades for both "early" and "anytime" TBS courses, are slightly higher than those for sets I and II, which include grades for only the "early" courses. Hereinafter, composite sets III and IV will be referred to as the "anytime" sets; and set I and II, as the "early" sets. Within the "early" and "anytime" sets, validities are slightly higher for those composite sets that include GCT subtest scores (II and IV) than for those that include the GCT total score only (I and III). These results indicate that validities increase as more TBS and aptitude information goes into the composites and that these composites can be used to predict follow-on school performance.

Evaluation of the Composites for Differential Prediction

The four sets of composites listed in Table 9 were compared using a computer-based procedure[5] for assigning all persons in a group to a set of jobs or schools such that quotas are filled and overall performance will be optimal. To use this procedure, each person must have expected performance (utility) scores for all the possible jobs. For the present study, the utilities were the officers' predicted school performance scores ($\hat{Z}$) in each of the four large schools. Four sets of scores were computed from Composites Sets I to IV, and an optimal assignment was made with each set.

Only officers in the four cross-validation samples who had complete predictor data were included. Quotas were then set to equal the number of officers in the resulting sample who had actually attended each school. Results are presented in Table 10, which shows that mean expected performance with the "anytime" sets is better than that with the "early" sets. Within the "early" pair, predicted performance with Set II, which includes GCT subtest scores, is better than that with Set I, which includes the GCT total score. Thus, as with validities, mean utilities increase as more information goes into the composites.

To compare the optimization strategy with current assignment procedures, mean utilities (predicted grades) for the officers who actually attended each school were computed, again using the four sets of composites. As seen in Table 10, the utilities obtained are always considerably lower than those obtained with the optimal assignment method.

Table 10 shows that Predictor Set IV is the best predictor of performance, followed by Set III. Both of these sets include the four "anytime" TBS courses. Therefore, if they

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[5]The procedure is the Ford-Fulkerson algorithm (1956) for solving the Hitchcock-Koopmans transportation problem. The computer program was developed by Wolfe (1971).

Table 8

Pearson Correlation Coefficients Between Predictors and Criterion in the Developmental and Cross-Validation Samples

	Follow-on School															
	Combat Engineer				Basic Communication				Ground Supply				Field Artillery			
Variables	Mean	SD	N	r	Mean	SD	N	r	Mean	SD	N	r	Mean	SD	N	r
Developmental Sample																
FSG (criterion)	91.1	4.8	133	-	88.4	5.6	110	-	88.2	5.3	146	-	89.8	5.4	260	-
TBS Course Grade:																
1st Command Evaluation	84.1	6.0	108	.24**	83.2	5.0	81	.21*	83.4	4.7	123	.43**	85.1	6.1	223	.36**
Basic Tactics	88.2	9.4	74	.41**	91.7	7.7	67	.54**	88.7	8.5	109	.54**	91.0	7.1	130	.34**
Personnel Administration	86.9	7.6	108	.44**	88.6	8.9	81	.61**	87.9	8.2	123	.49**	89.7	8.2	223	.45**
Crew-Served Weapons	89.3	6.5	76	.48**	87.4	8.1	68	.66**	88.4	8.2	117	.39**	90.4	6.8	143	.44**
Military Law	84.8	10.1	108	.39**	89.1	8.1	81	.43**	86.2	8.5	123	.49**	88.5	9.0	223	.44**
Communications	90.8	5.5	76	.14	91.2	6.5	68	.21*	89.9	7.1	117	.16*	92.0	7.0	143	.28**
Aptitude Test Score:																
ALAT	20.3	8.4	116	.34**	22.6	10.8	90	.37**	19.0	8.7	129	.50**	25.9	11.0	229	.30**
GCT Total	127.5	13.6	126	.52**	123.2	11.3	98	.54**	123.6	11.6	141	.45**	132.1	11.8	238	.33**
GCT RV Subtest	130.0	13.2	126	.36**	130.2	13.5	98	.29**	128.1	12.4	141	.37**	135.0	12.6	238	.15**
GCT AC Subtest	123.2	14.2	126	.44**	118.2	13.8	98	.45**	119.5	11.4	141	.34**	126.6	12.2	238	.27**
GCT AR Subtest	121.0	16.0	126	.48**	116.9	14.0	98	.53**	118.5	13.6	141	.46**	126.5	12.6	238	.30**
GCT PA Subtest	124.2	16.6	126	.44**	117.5	15.8	98	.37**	118.1	17.5	141	.32**	126.8	15.8	238	.28**
Cross-Validation Sample																
FSG (criterion)	90.8	4.7	87	-	88.1	5.8	62	-	87.8	5.8	121	-	89.8	4.7	163	-
TBS Course Grade:																
1st Command Evaluation	84.3	6.5	65	.30**	82.5	6.4	40	.25	83.3	5.5	106	.20*	84.9	6.7	138	.40**
Basic Tactics	88.2	7.3	49	.30*	91.3	6.8	34	.68**	87.9	7.6	96	.54**	89.3	7.7	80	.53**
Personnel Administration	86.4	9.0	65	.54**	87.8	9.6	40	.75**	86.0	8.8	106	.49**	88.1	8.5	138	.44**
Crew-Served Weapons	86.9	8.6	50	.51**	85.8	9.8	35	.72**	87.7	7.4	100	.40**	87.9	8.6	89	.52**
Military Law	86.7	10.2	65	.49**	86.6	8.9	40	.60**	86.6	9.1	106	.49**	88.6	8.4	138	.45**
Communications	92.3	6.5	51	.23	92.4	5.5	35	.33*	90.4	7.2	100	.46**	93.3	6.2	89	.27**
Aptitude Test Score:																
ALAT	21.0	9.4	71	.54**	23.9	10.7	54	.38**	18.2	9.0	109	.55**	23.6	9.7	142	.31**
GCT Total	125.1	13.2	80	.55**	125.5	13.5	60	.52**	121.8	12.3	117	.56**	129.9	11.6	148	.43**
GCT RV Subtest	130.6	13.4	80	.31**	131.2	12.1	60	.17	128.2	13.4	117	.45**	133.7	11.7	148	.41**
GCT AC Subtest	119.0	15.8	80	.56**	119.8	14.5	60	.42**	119.0	13.5	117	.51**	125.1	12.1	148	.35**
GCT AR Subtest	117.5	13.7	80	.51**	119.4	16.1	60	.50**	116.2	14.6	117	.50**	124.1	13.0	148	.35**
GCT PA Subtest	122.3	15.3	80	.45**	121.4	19.2	60	.52**	115.4	17.3	117	.34**	124.0	15.6	148	.30**

*p < .05.
**p < .01.

Table 9

Beta Weights and Validities in Predicting Final School Grade

Predictors	Set I School CE	BC	GS	FA	Set II School CE	BC	GS	FA	Set III School CE	BC	GS	FA	Set IV School CE	BC	GS	FA
								Beta Weights								
Aptitude Test Score:																
GCT Total	.413	.318	--	--	--	--	--	--	.357	--	--	--	--	--	--	--
GCT RV Subtest	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GCT AR Subtest	--	--	--	--	.227	.243	--	--	--	--	--	--	.243	--	--	--
GCT AC Subtest	--	--	--	--	--	.214	--	--	--	--	--	--	--	.265	--	--
GCT PA Subtest	--	--	--	--	.263	--	--	--	--	--	--	--	.255	--	--	--
ALAT	--	.143	.360	.237	--	--	.360	.237	--	--	.360	--	--	--	.360	--
TBS Test Grade:																
Basic Tactics	.224	.396	.350	.225	.279	.458	.350	.225	--	.257	.350	--	--	.375	.350	--
Ist Command Evaluation	.098	--	.266	.297	--	--	.266	.297	--	--	.266	.236	--	--	.266	.236
Personnel Administration	--	--	--	--	--	--	--	--	.253	.271	--	.256	.336	--	--	.256
Military Law	--	--	--	--	--	--	--	--	--	--	--	.276	--	--	--	.276
Crew-served Weapons	--	--	--	--	--	--	--	--	.221	.462	--	--	--	.462	--	--
Communication	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
								Validities								
R--Developmental Sample[a]	.575	.663	.697	.505	.583	.688	.697	.505	.634	.781	.697	.568	.615	.792	.697	.568
R^2--Developmental Sample	.331	.440	.486	.255	.340	.474	.486	.255	.402	.611	.486	.323	.378	.628	.486	.323
r--Cross-validation Sample[b]	.559	.763	.676	.584	.522	.763	.676	.584	.675	.859	.676	.639	.633	.859	.676	.639

[a]R = multiple correlation.

[b]r = Pearson product-moment correlation.

Table 10

Predicted Standardized FSG Means and Standard Deviations
Of Optimal and Actual Assignments Using Composite Sets I to IV

Composite Set	Across Schools	Combat Engineer (CE)		Basic Communication (BC)		Ground Supply (GS)		Field Artillery (FA)	
	Mean	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Optimal Assignments									
I	.15	-.17	.47	.43	.41	.76	.43	-.53	.39
II	.19	.01	.53	.37	.40	.77	.43	-.50	.39
III	.30	.30	.56	.51	.47	.61	.60	-.17	.55
IV	.34	.33	.54	.53	.57	.63	.60	-.10	.53
Quota[a]	240	44		32		91		73	
Actual Assignments									
I	-.10	-.15	.46	.00	.69	-.09	.65	-.14	.56
II	-.11	-.15	.45	-.03	.71	-.09	.65	-.14	.56
III	-.09	-.22	.67	-.08	.88	-.09	.65	-.01	.50
IV	-.08	-.15	.62	-.09	.84	-.09	.65	-.01	.50
Quota[a]	240	44		32		91		73	

[a]Officers with complete predictor data who actually attended the school.

are adopted, the TBS curricula would have to be changed so that the four courses are taught prior to MOS assignment. The next best predictors are those in Set II. Since Set II composites do not require curriculum changes and they do improve overall assignment in the four largest MOSs, they appear to be the most practical choice for the interim phase of the classification system.

Development of Composites for Manual Use

In the event that these scores were to be computed manually (or with a hand calculator), calculations can be greatly simplified by replacing the predictors' exact weights with appropriate integer weights and using specially developed tables to indicate predicted performance in each school. Therefore, using the predictors in Set II equations, alternative sets of integer-weights were explored, and Pearson correlations of all the new composites with FSG were computed separately in the developmental and in the cross-validation samples to assess integer-weight effect in the composites' validities. Only cases with complete predictor data were included in these analyses. As can be seen in Table 11, the use of the simpler weights (when compared with the corresponding exact

Table 11

Validities and Cross-Validities of Composites
Derived from Predictor Set II

		Exact Weights	Integer-Weights				
School	Predictor	B-Coefficients	Composite 1	Composite 2	Composite 3	Composite 4	Composite 5
Combat Engineer (CE)	Basic Tactics Grade	.125	1	2	2	1	0
	GCT AR Subtest Score	.075	1	1	0	0	1
	GCT PA Subtest Score	.041	1	1	1	1	1
	Validation r (N = 67)	.48	0.46	0.48	0.43	0.40	0.40
	Cross-validation r (N = 45)	.51	0.51	0.50	0.42	0.42	0.48
Basic Communic. (BC)	Basic Tactics Grade	.331	2	1	1	3	2
	GCT AR Subtest Score	.123	1	1	1	1	0
	GCT AC Subtest Score	.091	0	0	1	1	1
	Validation r (N = 58)	.70	0.69	0.67	0.65	0.70	0.67
	Cross-validation r (N = 32)	.76	0.77	0.75	0.70	0.76	0.71
Ground Supply (GS)	1st Command Evaluation Grade	.336	1	0	3		
	Basic Tactics Grade	.223	1	1	2		
	ALAT Score	.224	1	1	2		
	Validation r (N = 99)	.70	0.69	0.65	0.70		
	Cross-validation r (N = 91)	.67	0.69	0.67	0.67		
Field Artillery (FA)	1st Command Evaluation Grade	.259	1	1	2		
	Basic Tactics Grade	.186	1	1	1		
	ALAT Score	.129	0	1	1		
	Validation r (N = 115)	.47	0.42	0.46	0.47		
	Cross-validation r (N = 73)	.56	0.58	0.54	0.54		

Note: All Ns represent cases with complete predictor data only.

weights composite) results in very small changes in the composites' cross-validities. There were slight losses in 11 of the composites and increases in the remaining 5.[6]

Since all the validities are acceptable, the next step was to select, from the three to five integer-weight composites derived per school, those that would maximize differentiation among schools. This should be accomplished by selecting, for each school, the composite having the lowest intercorrelations with the other schools' composites. Thus, based on the intercorrelations presented in Table 12, the following composites were chosen: Composite 5 in CE school (CE5), Composites 3 and 5 in BC school (BC3 and BC5), Composite 2 in GS school (GS2), and Composite 1 in FA school (FA1). The equations for these composites are as follows:

- CE5 = GCTAR + GCTPA
- BC3 = Basic Tactics + GCTAR + GCTAC
- BC5 = 2 (Basic Tactics) + GCTAC
- GS2 = Basic Tactics + ALAT
- FA1 = 1st Command Evaluation + Basic Tactics

Finally, simulated optimal assignments were made to evaluate differential prediction and to choose between the two options for the BC school--BC3 and BC5. For this analysis, the raw scores obtained with the equations above were transformed--using linear regressions--into predicted standardized final school grades ($\hat{Z}$). The resulting equations are as follows:

- $\hat{Z}_{CE5} = -5.012 + (.0207)CE5$
- $\hat{Z}_{BC3} = -8.925 + (.0274)BC3$
- $\hat{Z}_{BC5} = -11.670 + (.0389)BC5$
- $\hat{Z}_{GS2} = -6.189 + (.0564)GS2$
- $\hat{Z}_{FA1} = -7.990 + (.0460)FA1$

Next, two sets of composites were formed, Set IIa with $\hat{Z}_{CE5}$, $\hat{Z}_{BC3}$, $\hat{Z}_{GS2}$, and $\hat{Z}_{FA1}$, and Set IIb with $\hat{Z}_{CE5}$, $\hat{Z}_{BC5}$, $\hat{Z}_{GS2}$, and $\hat{Z}_{FA1}$. The sets were used separately to make optimal assignments and their utilities compared. Results are provided in Table 13, which shows that superior optimal assignments were obtained with Set IIa.

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[6]Increases in cross validity when integer-weights are used instead of exact weights are not unusual (Dawes, 1979).

Table 12

Intercorrelations of Integer-Weight Composites
In the Cross-Validation Sample (N = 241)

	Integer-Weight Composites[a]										
	BC1	BC2	BC3[b]	BC4	BC5[b]	GS1	GS2[b]	GS3	FA1[b]	FA2	FA3
CE1	.82	.88	.83	.80	.67	.63	.63	.61	.50	.63	.58
CE2	.90	.91	.84	.87	.77	.71	.72	.68	.61	.71	.64
CE3	.81	.76	.66	.78	.74	.71	.72	.68	.68	.71	.64
CE4	.70	.69	.63	.67	.60	.61	.60	.59	.54	.61	.57
CE5[b]	.67	.78	.77	.66	.51	.49	.48	.48	.32	.49	.47
BC1						.76	.80	.71	.71	.76	.67
BC2						.70	.72	.66	.59	.70	.62
BC3[b]						.66	.68	.63	.50	.66	.59
BC4						.77	.81	.72	.69	.77	.68
BC5[b]						.77	.81	.72	.71	.77	.68
GS1									.84	1.00	.97
GS2[b]									.67	.93	.80
GS3									.87	.99	.99

[a]CE1 refers to Composite 1 for school CE, CE2 to Composite 2 for school CE, etc.

[b]Indicates composites selected for possible manual use.

Table 13

Predicted Standardized FSG Means and Standard
Deviations of Optimal Assignments Using Integer-Weight Composites

		Follow-on Schools							
	Across Schools	CE		BC		GS		FA	
Composite Set	Mean	Mean	SD	Mean	SD	Mean	SD	Mean	SD
IIa	.39	.11	.50	.89	.49	.60	.56	.06	.44
IIb	.37	.13	.53	.91	.43	.58	.56	.01	.43
Quota[a]	241	45		32		91		73	

[a]Officers with complete predictor data who actually attended the school.

Finally, another analysis was conducted using, as a measure of talent utilization, the proportion of students above or below the median predicted FSG. In the current sample, 50 percent of the officers in each school will score, by definition, above the median predicted FSG computed with the corresponding composite. As shown in Table 14, using Set IIa, 73 percent of the officers would be expected to perform above the median when optimally assigned to the four schools, compared to 70 percent for Set IIb. (Results of a median analysis with the exact weights composites (Sets I to IV) appear in Table 15.)

Table 14

Officers Expected to Score Above the Median in Optimal Assignments with Integer-Weight Composites

School	Quota	Composite Set			
		Set IIa		Set IIb	
		N	%	N	%
CE	45	24	53	23	51
BC	32	31	97	28	88
GS	91	80	88	82	90
FA	73	41	56	36	49
Total	241	176	73	169	70

Table 15

Officers Expected to Score Above the Median in Optimal Assignments with Composites Sets I to IV

School	Quota	Composite Set							
		I		II		III		IV	
		N	%	N	%	N	%	N	%
CE	44	19	43	24	53	36	80	36	80
BC	32	27	84	26	81	23	72	27	84
GS	91	90	99	90	99	78	86	81	89
FA	73	5	7	7	10	30	41	34	47
Total	240	141	59	147	61	167	70	178	74

Based on predictor Set IIa, a work sheet (Figure 1) was then prepared. It provides step-by-step instructions for computing an officer's predicted scores in the four schools and a table for converting the raw scores into percentile ranks, allowing the user to compare the four values directly.

Implementation

Operationally, the composites can be used in three ways:

1. The predicted scores computed for each student would be used manually, on a case-by-case basis, as additional information when making the assignment decision.

2. All the members of the group would be assigned simultaneously with a computer-based procedure. The resulting assignments can be used directly or with minor changes since all the predicted scores are also available.

3. Officers with the highest scores in each MOS would be assigned first, manually, and the rest would be assigned with the computer. The rationale of this approach is to preselect officers who are singularly suited to certain schools and to optimize the overall utilization of the rest of the group.

CONCLUSIONS

Composites based on TBS grades and aptitude test scores are strong predictors of success at the four schools with samples large enough for stable analyses. As more TBS course information goes into composite development, validity increases and greater differentiation among follow-on schools is obtained.

Irrespective of TBS courses, composites developed from GCT subtests have higher validities and result in greater differentiation than do those based on GCT total. This suggests that the use of a more comprehensive differential aptitude battery may further increase the magnitude of differental prediction.

Although CEMC did not contribute to performance prediction, this result must be interpreted with caution. Since education major is already a factor in some assignment decisions and its use is influenced to an unknown extent by other variables (e.g., the officer's interests and his GPA), proper statistical analyses with this variable were not possible.

RECOMMENDATIONS

1. The Set II or IIa composites should be used to aid in assignments to the CE, BC, GS, and FA schools.

2. To obtain larger sample sizes, collection of performance data at all follow-on schools should continue. In the small MOSs, follow-on schools curricula should be analyzed with the purpose of grouping related MOSs that, alone, do not yield enough subjects for stable analyses.

PERCENTILE	COMPOSITE SCORE CE	BC	GS	FA
99	315	405 & OVER	149 & OVER	200
98	315	398-404	145-148	200
97	315	392-397	142-144	200
96	315	388-391	140-141	200
95	315	384-387	139	200
94	315	381-383	137-138	200
93	312-315	379-380	136	200
92	309-311	376-378	135	200
91	306-308	374-375	133-134	200
90	303-305	372-373	132	200
89	300-302	370-371	-	199
88	298-299	368-369	131	199
87	296-297	366-367	130	198
86	294-295	365	129	197
85	291-293	363-364	128	196
84	290	362	127	195
83	288-289	360-361	-	194
82	286-287	359	126	-
81	284-285	358	125	193
80	282-283	356-357	-	192
79	281	355	124	191
78	279-280	354	-	-
77	277-278	352-353	123	190
76	276	351	122	189
75	274-275	350	-	188
74	273	349	121	-
73	271-272	348	-	187
72	270	347	120	186
71	268-269	346	-	-
70	267	345	119	185
69	266	344	-	-
68	264-265	343	118	184
67	263	342	-	183
66	262	341	117	-
65	260-261	340	-	182
64	259	339	116	-
63	258	338	-	181
62	257	337	115	-
61	255-256	336	-	180
60	254	335	114	179
59	253	334	-	-
58	252	333	-	178
57	250-251	332	113	-
56	249	331	-	177
55	248	330	112	-
54	247	329	-	176
53	246	328	111	-
52	244-245	-	-	175
51	243	327	110	174
50	242	326	-	-
49	241	325	-	173
48	239-240	324	109	-
47	238	323	-	172
46	237	322	108	
45	236	321	-	171
44	235	320	107	-
43	233-234	319	-	170
42	232	318	106	169
41	231	317	-	-
40	230	316	-	168
39	228-229	315	105	-
38	227	-	-	167
37	226	314	104	-
36	225	313	-	166
35	223-224	312	103	165
34	222	311	-	-
33	221	310	102	164
32	219-220	309	-	-
31	218	308	101	143
30	216-217	306-307	-	162
29	215	305	100	-
28	214	304	-	161
27	212-213	303	99	-
26	211	302	-	160
25	209-210	301	98	159
[illegible]	208	[illegible]	[illegible]	158
[illegible]	[illegible]	[illegible]		
22	204-205	297-298	96	157
21	203	296	-	156
20	201-202	295	95	155
19	199-200	293-294	94	-
18	197-198	292	-	154
17	195-196	291	93	153
16	193-194	289-290	92	152
15	191-192	288	91	151
14	189-190	286-287	-	150
13	187-188	284-285	90	149
12	185-186	282-283	89	148
11	182-184	280-281	88	147
1-10	181 & UNDER	279 & UNDER	87 & UNDER	146 & UNDER

WORK SHEET AND EXAMPLE

Name *Example* Date ________

Company ________ SSN ________

Computation of estimates of follow-on school grades for Combat Engineer (CE), Basic Communication (BC), Ground Supply (GS), and Field Artillery (FA).

1. From the student's records, obtain the following scores:

GCT Arithmetic Computation	GCTAC =	*100.*
GCT Pattern Analysis	GCTPA =	*120.*
GCT Arithmetic Reasoning	GCTAR =	*93.*
Army Language Aptitude Test	ALAT =	*43.*
Basic Tactics	=	*89.3*
1st Command Evaluation	=	*85.2*

2. For each of the four schools: (1) Compute the raw score using the formulas given below, (2) round to the nearest whole number, (3) locate and circle the rounded raw score under the table column for the school, and (4) read the corresponding percentile on the same line.

Percentile

Combat Engineer

Raw score = GCTAR + GCTPA

Raw Score = *120 + 93 = 213* — CE = *27th*

Basic Communication

Raw score = Basic Tactics + GCTAR + GCTAC

Raw score = *89.3 + 93 + 100 = 282.3*

Rounded raw score = *282* — BC = *12th*

Ground Supply

Raw score = Basic Tactics + ALAT

Raw score = *89.3 + 43 = 132.3*

Rounded raw score = *132* — GS = *90th*

Field Artillery

Raw score = Basic Tactics + 1st Command Evaluation

Raw score = *89.3 + 85.2 = 174.5*

Rounded raw score = *175* — FA = *52nd*

Notes and recommendations

Interpretation

The raw scores were converted to percentile scores in order to better compare and interpret them. Since percentiles are measures of relative standing, this allows one to estimate not only in which school the officer's performance level will be highest, but also how his predicted scores compare to those of previous TBS graduates. The officer in this example will probably do his best in Ground Supply School, will perform adequately in Field Artillery, and should not be assigned to Basic Communication.

Figure 1. Work sheet for computing officer's predicted scores in CE, BC, GS, and FA schools.

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APPENDIX A

CATEGORIES OF CIVILIAN EDUCATION MAJORS

TABLE A-1

CATEGORIES OF CIVILIAN EDUCATION MAJORS

I. ENGINEERING AND ARCHITECTURE

J0	GRADUATE LOGISTICS
L9	LOGISTICS MANAGEMENT
M2	DEFENSE SYSTEMS ANALYSIS (FORMERLY SYSTEMS ANALYSIS)
M2	SYSTEMS ANALYSIS (REDESIGNATED DEFENSE SYSTEMS ANALYSIS)
98	TRANSPORTATION (ALL MEANS)
H1	TRAFFIC MANAGEMENT
A9	STRUCTURES
K2	BUILDING SCIENCE
00	HIGHWAY ENGINEER
E8	ENGINEERING, ADMINISTRATION
E5	ENGINEERING, MANAGEMENT
J5	MANAGEMENT & INDUSTRIAL ENGINEERING
A9	INDUSTRIAL DESIGN
E6	ORDNANCE SYSTEMS ENGINEERING
M4	COMPUTER ENGINEERING
K8	NUCLEAR ENGINEERING
41	ENGINEERING, METALLURGICAL
42	ENGINEERING, MINING
43	ENGINEERING, PETROLEUM
C6	ENGINEERING, PHYSICS
44	ENGINEERING, POWER & FUEL
45	ENGINEERING, RADIO
A7	ENGINEERING, SAFETY
46	ENGINEERING, SANITARY
A6	ENGINEERING, TOOL
47	ENGINEERING, TRAFFIC
31	ENGINEERING, AERONAUTICAL
H2	ENGINEERING, AEROSPACE
A4	ENGINEERING, AGRICULTURAL
B6	ENGINEERING, ARCHITECTURAL
P5	ENGINEERING, BIOMEDICAL
32	ENGINEERING, CHEMICAL
33	ENGINEERING, CIVIL
34	ENGINEERING, COMMUNICATION
P4	ENGINEERING, ELECTRIC POWER TECHNOLOGY
35	ENGINEERING, ELECTRICAL
0A	ENGINEERING, ELECTRONIC
36	ENGINEERING, GEOLOGICAL
37	ENGINEERING, HYDRAULIC
38	ENGINEERING, INDUSTRIAL
39	ENGINEERING, MARINE
40	ENGINEERING, MECHANICAL
A5	ENGINEERING
L7	CERAMIC ENGINEER
15	AERONAUTICS
C0	LANDSCAPE DESIGN
17	ARCHITECTURE

Table A-1 (Con't)

II. BUSINESS AND MANAGEMENT

S3 SALESMAN, GENERAL
K1 AIRLINE/AIRPORT MANAGEMENT
C2 REAL ESTATE
B5 INSURANCE
G4 OPERATIONS RESEARCH
D9 OPERATIONS ANALYSIS
A1 RESTAURANT MANAGEMENT
A0 HOTEL MANAGEMENT
P3 HOUSING ADMINISTRATION
83 SECRETARIAL STUDIES
G0 AVIATION MANAGEMENT
J8 RESEARCH AND DEVELOPMENT (MANAGEMENT)
M7 SYSTEMS INVENTORY MANAGEMENT
20 BANKING & FINANCE
24 COMMERCE
22 BUSINESS ADMINISTRATION
N8 BUSINESS MANAGEMENT
D7 COMPTROLLERSHIP
G2 FINANCIAL MANAGEMENT
K5 FINANCE
D1 GENERAL MANAGEMENT
M6 GOVERNMENT FINANCIAL MANAGEMENT
B1 INDUSTRIAL RELATIONS
C4 LABOR MANAGEMENT
63 MARKETING
D6 PERSONNEL MANAGEMENT
73 PERSONNEL ADMINISTRATION
N6 ADMINISTRATION
13 ACCOUNTING
L4 INDUSTRIAL ADMINISTRATION
55 INDUSTRIAL MANAGEMENT
M8 TECHNOLOGY OF MANAGEMENT
Q5 DATA PROCESSING
E7 COMPUTER SCIENCE (NON-TECHNICAL) (MANAGEMENT DATA SYSTEMS)
E7 MANAGEMENT DATA SYSTEMS (COMPUTER SCIENCE NON-TECHNICAL)
N0 MANAGEMENT INFORMATION SYSTEM
N5 SYSTEMS MANAGEMENT
H3 GOVERNMENTAL ADMINISTRATION
B2 POLICE ADMINISTRATION
80 PUBLIC ADMINISTRATION

Table A-1 (Con't)

III. PHYSICAL SCIENCES

B4	EARTH SCIENCE
E0	OCEANOGRAPHY
A7	GLASS TECHNOLOGY
23	CHEMISTRY
77	PHYSICS
19	ASTRONOMY
50	GEOLOGY
K9	NUCLEAR PHYSICS
66	METEOROLOGY
C9	GEOPHYSICS
C1	PHYSICAL SCIENCE
P9	NATURAL RESOURCES
P7	AGRICULTURE ECONIMICS
D4	WILDLIFE MANAGEMENT
B8	HORTICULTURE
48	FORESTRY
M0	FISHERIES
Q8	FISH & GAME WARDEN
K3	DAIRY MANUFACTURING
96	ANIMAL HUSBANDRY
16	AGRICULTURE
G5	AGRONOMY
M1	ENTOMOLOGY
03	BACTERIOLOGY
21	BOTANY
04	BIOLOGY
N4	BIOLOGICAL SCIENCE
H5	GENETICS
P0	MICROBIOLOGY
09	PHYSIOLOGY
12	ZOOLOGY
M9	BIOCHEMISTRY
L0	PATHOLOGY
88	STATISTICS
M3	APPLIED MATHEMATICS
64	MATHEMATICS
M5	COMPUTER SCIENCE (TECHNICAL)
B4	SCIENCE
D3	NATURAL SCIENCE
70	NATURAL HISTORY
P2	FOOD SERVICE
G6	FOOD TECHNOLOGY
53	HOME ECONOMICS
90	TEXTILES
68	MORTUARY SCIENCE
08	PHARMACY
05	DENTISTRY
07	MEDICINE
82	RADIOLOGICAL TECHNOLOGY
58	LABORATORY TECHNICIAN
92	CHIROPRACTOR
71	NURSING
72	OPTOMETRY
L1	PRE-MEDICINE
11	VETERINARY MEDICINE

Table A-1 (Con't)

A8	HEALTH
N9	ENVIRONMENTAL HEALTH
67	MILITARY SCIENCE
C6	NAVAL SCIENCE
E1	U.S. NAVAL ACADEMY
E2	U.S. MILITARY ACADEMY
N7	U.S. MERCHANT MARINE ACADEMY
E4	U.S. COAST GUARD ACADEMY
E3	U.S. AIR FORCE ACADEMY

Table A-1 (Con't)

IV. SOCIAL SCIENCES

N3	HUMAN RELATIONS
F5	PSYCHOLOGY, EDUCATION
10	PSYCHOLOGY
P6	BEHAVIORAL SCIENCE
L6	ARAB STUDIES
G1	ASIATIC STUDIES
D0	LATIN AMERICAN STUDIES
D5	AMERICAN STUDIES
F9	RUSSIAN STUDIES
C5	FOREIGN SERVICE
26	CRIMINOLOGY
86	SOCIOLOGY
97	SOCIAL SCIENCE
02	ARCHAEOLOGY
01	ANTHROPOLOGY
49	GEOGRAPHY
28	ECONOMICS
H4	EUROPEAN HISTORY
52	HISTORY
51	GOVERNMENT
H0	INTERNATIONAL AFFAIRS
56	INTERNATIONAL RELATIONS/AFFAIRS
78	POLITICAL SCIENCE
L5	AMERICAN CIVILIZATION
80	SOCIAL STUDIES
85	SOCIAL WELFARE
R2	INVESTIGATOR
F4	LAW ENFORCEMENT
A9	RECREATION
83	INDUSTRIAL EDUCATION
F3	EDUCATION, TESTING & EVALUATION
A3	EDUCATION, SECONDARY
76	EDUCATION, PHYSICAL
F6	EDUCATION, PHILOSOPHY
F2	EDUCATION, GUIDANCE & COUNSELING
F7	EDUCATION, CURRICULUM & INSTRUCTION
J9	EDUCATION, ADMINISTRATION
29	EDUCATION
H8	CRIMINAL LAW
C3	PRE-LAW
06	LAW
H7	JURIDICAL SCIENCE
60	LIBRARY SCIENCE

V. ARTS AND HUMANITIES

74	PHILOSOPHY
91	THEOLOGY
87	SPEECH
L3	CLASSICS
94	ENGLISH
G7	ENGLISH LITERATURE
59	LANGUAGE
61	LITERATURE
18	ARTS, LIBERAL
P1	ARTS & SCIENCE
D2	HUMANITIES
G3	GENERAL STUDIES
F8	ARTS & LETTERS
F1	COMMUNICATION MANAGEMENT
E9	RADIO BROADCASTING
L2	TELEVISION BROADCASTING
G9	COMMUNICATIONS
K4	FILM-TV PRODUCTION
81	PUBLIC RELATIONS/JOURNALISM
14	ADVERTISING
57	JOURNALISM
L8	CINEMATOGRAPHY
27	DRAMATICS
A2	ART
93	COMMERCIAL ART
95	FINE ART
75	PHOTOGRAPHY
69	MUSIC

VI. TRADES AND SERVICES

R3 LIFE GUARD
R6 MAIL CARRIER
65 MECHANICAL DRAWING
Q4 CABINET MAKER
K0 AIRCRAFT DESIGN TECHNICIAN
54 INDUSTRIAL ARTS & CRAFTS
K6 INDUSTRIAL ARTS
S0 TRACTOR, TRAILER TRUCK DRIVER
T1 TRUCK DRIVER
Q9 HEAVY EQUIPMENT OPERATOR
R1 HIGHWAY MAINTENANCE
R0 PRESSMAN
S1 PRINTER
79 PRINTING
T2 WAREHOUSEMAN
G8 PACKAGING
R7 MAINTENANCE
S8 STONE MASON
R5 LOGGER
S4 SAND BLASTER
S7 SOLDERER, ASSEMBLER
S5 SHEET METAL WORKER
S9 TOOL & DIE MAKING
R8 METAL WORKER
S6 SHIPFITTER
T3 WELDING, ARC
T1 WELDING, GAS
Q7 FIREMAN
30 ELECTRONICS
P8 ELECTRONICS TECHNOLOGY
Q6 ELECTRICAL MAINTENANCE
R4 LINEMAN, ELECTRICAL
C7 RADIO-TV SERVICE
Q1 APPLIANCE REPAIRMAN
T5 WIREMAN, CABLE
S2 REFRIGERATION MECHANIC
P9 OFFICE MACHINE REPAIRMAN
K7 INDUSTRIAL TECHNICIAN
62 MACHINE TECHNOLOGY
N1 AUTOMOTIVE TECHNOLOGY
N2 AVIATION MAINTENANCE TECHNOLOGY
Q3 BARTENDER
25 COSMETOLOGY
Q2 BARBER

99 USAFI GED/OR ANY ACCREDITED CIVILIAN HIGH SCHOOL EQUIVALENCY
00 NO MAJOR SUBJECT INDICATED

APPENDIX B

FREQUENCIES OF TBS COURSES BY FOLLOW-ON SCHOOL

Frequencies of TBS Courses by Follow-on School

TBS Course/Test	Course[a] Classification	Follow-on School: Air Support N	Combat Engineer N	Anti-Air Warfare N	Basic Communic. N	Ground Supply N	Field Artillery N	Aviation Supply N	Tank N	Amphibious Vehicle N	Air Defense N
Personnel Administration	A	38	173	22	121	229	361	67	73	25	53
Military Law	A	39	173	22	121	229	361	67	73	20	53
Rifle Qualification	D	39	172	22	121	229	360	67	73	25	52
Pistol Qualification	D	39	172	22	121	229	360	67	73	25	53
First Contemporary Evaluation	D	39	173	22	121	229	361	67	72	25	52
Second Contemporary Evaluation	D	39	173	22	120	229	361	67	72	25	53
First Command Evaluation	L	39	173	22	121	229	361	67	73	20	53
Second Command Evaluation	L	39	173	22	121	229	361	67	73	25	53
Practical Drill Test	D	36	159	21	118	208	353	60	67	18	52
Crew-served Weapons	A	[illegible]	126	14	103	217	232	58	59	17	39
Water survival/survival swimming	S	8	36	7	12	4	104	7	12	1	11
Single run obstacle course	D	8	41	7	13	7	113	8	13	1	12
Double run obstacle course	D	32	154	21	115	216	306	62	66	19	46
Second Physical Fitness Test	L	39	173	22	121	229	359	67	73	25	53
First Physical Fitness Test	D	8	45	8	18	12	129	9	14	3	14
15-minute Presentation	D	27	134	17	57	141	286	43	49	19	38
10-minute Presentation	D	8	22	4	36	52	53	15	13	[illegible]	12
Student Briefings	S	4	16	1	28	35	22	9	11	5	3
General Military Subjects	V	19	89	9	39	130	157	34	35	16	24
General Military Subjects I	V	12	38	5	64	87	75	24	24	1	15
General Military Subjects II	V	12	38	5	64	87	75	24	24	1	15
Map & Aerial Photograph Reading	S	25	84	13	82	99	204	33	38	4	29
Mapping and Land Navigation	V	19	89	9	39	130	157	34	35	16	24
Land Navigation	V	25	84	13	81	99	204	33	38	4	29
Basic Tactics	E	31	123	14	101	205	210	54	56	17	36
Tactics/Weapons I	S	0	4	0	2	12	22	4	3	0	3
Defensive Tactics	L	31	123	14	101	205	210	54	56	17	36
Tactics II	L	0	4	0	2	12	22	4	3	0	3
Offensive Tactics	L	31	123	14	101	205	210	54	56	17	36
Tactics/Weapons III	L	0	4	0	2	12	22	4	3	0	3
Advanced Platoon Tactics	L	31	123	14	101	205	210	54	56	17	36
Individual Weapons	D	31	123	14	101	205	210	54	56	17	36
Mortars	D	31	123	14	101	205	210	54	56	17	36
Supporting Arms	S	13	59	6	50	104	58	20	26	12	14
FDC Procedures and Supporting Arms	S	14	49	6	31	68	100	23	20	4	14
81 mm FDC	S	4	15	2	20	33	52	11	10	1	8
Communications	A	31	127	14	103	217	232	58	59	17	39

[a]Courses were classified as follows:

E : Conducted early in curriculum schedule, prior to MOS assignment.
A : Conducted anytime, prior to or after MOS assignment.
L : Conducted late, after MOS assignment.
D : Discontinued.
S : Sample size too small.
V : Variable content.

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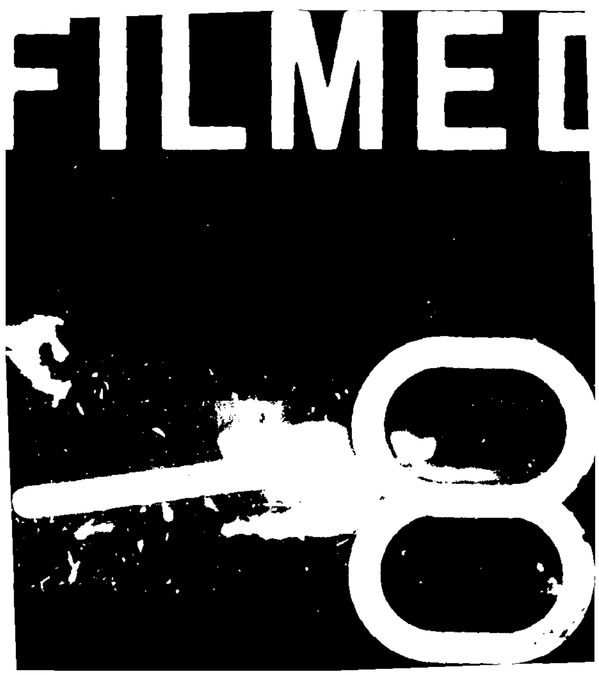
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